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(54) **SYSTEMS AND METHODS FOR RECEIVING INFRARED DATA WITH A CAMERA DESIGNED TO DETECT IMAGES BASED ON VISIBLE LIGHT**

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(58) **Field of Classification Search**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,225,903	A	7/1993	Wittrin	
6,107,618	A	8/2000	Fossum et al.	
6,700,613	B1 *	3/2004	Bryant et al.	348/164
6,809,792	B1 *	10/2004	Tehranchi et al.	348/E5.137
7,460,160	B2 *	12/2008	Hershey	H04N 5/33 348/E5.09
8,416,302	B2 *	4/2013	Zhang	H04N 5/23219 348/164
8,614,747	B2 *	12/2013	Alt	G06T 7/0044 348/164
8,848,059	B2 *	9/2014	Tiscareno et al.	348/164
2005/0265584	A1	12/2005	Dobson et al.	

(Continued)

FOREIGN PATENT DOCUMENTS

WO 2009/068836 6/2009

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(57) **ABSTRACT**

Systems and methods for receiving infrared data with a camera designed to detect images based on visible light are provided. A system can include a camera and image processing circuitry electrically coupled to the camera. The image processing circuitry can determine whether each image detected by the camera includes an infrared signal with encoded data. If the image processing circuitry determines that an image includes an infrared signal with encoded data, the circuitry may route at least a portion of the image (e.g., the infrared signal) to circuitry operative to decode the encoded data. If the image processing circuitry determines that an image does not include an infrared signal with encoded data, the circuitry may route the image to a display or storage. Images routed to the display or storage can then be used as individual pictures or frames in a video because those images do not include any effects of infrared light communications.

14 Claims, 9 Drawing Sheets